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Optimization and Control of Production of Graphene

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ABSTRACT

Graphene is a 2-dimensional element of high practical importance. Despite its exceptional properties, graphene's real applications in industrial or commercial products have been limited. There are many methods to produce graphene, but none has been successful in commercializing its production. Roll-to-roll plasma chemical vapor deposition (CVD) is used to manufacture graphene at large scale. In this research, we present a Bayesian linear regression model to predict the roll-to-roll plasma system's electrode voltage and current; given a particular set of inputs. The inputs of the plasma system are power, pressure and concentration of gases; hydrogen, methane, oxygen, nitrogen and argon. This voltage/current modeling will help in better understanding the plasma physics which is directly related to the quality of graphene produced. The above model is based on a dataset which was formed using 100 different input conditions and then measuring the electrode voltage/current corresponding to those inputs. Our model demonstrates the advantages of Bayesian approach that captures the epistemic uncertainty in the model parameters, which is important when dealing with small size data set. Our algorithm predicts the regression coefficients which are used to approximate the output voltage and current. The model presented in this research will give insights about the plasma physics and thus help in optimization of production of graphene.

KEYWORDS

Optimization, Graphene, Bayesian Linear Regression